UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/894,186	06/28/2001	Yuen Chuen Chan	774-010087-US (PAR)	5310

2512 7590 07/18/2003

PERMAN & GREEN
425 POST ROAD
FAIRFIELD, CT 06824

EXAMINER	
SONG, MATTHEW J	

ART UNIT	PAPER NUMBER
1765	14

DATE MAILED: 07/18/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/894,186	Applicant(s) CHAN ET AL.
	Examin r Matthew J Song	Art Unit 1765

-- The MAILING DATE of this communication app ars on th cov r sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 27 June 2003 .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-11 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-11 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-11 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 1 recites, "uniformly varying the pressure of the system by varying the pressure of a non-growth source constituent gas" in lines 15-16. There is no support in the instant specification for "uniformly" varying pressure because the instant specification merely teaches varying pressure. Also, there is no support in the instant specification for "varying the pressure of a non-growth source constituent gas" because the specification merely provides support for hydrogen gas.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-2, 5 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bernardi (US 4,906,325) in view of Dugger (US 5,503,103).

Bernardi discloses a reactor under a hydrogen flow maintained at atmospheric pressure (col 3, ln 35-40) and a growth solution at a temperature of 485°C, this reads on applicant's temperature above the saturation temperature, and by reducing to the solution temperature of 470°C a crystal layer is deposited on a substrate, this reads on applicant's temperature at or below the saturation temperature (col 5, ln 40-67). Bernardi also discloses at a 2 or 3 degree lower temperature for a supersaturation condition allowing growth to start is obtained (col 5, ln 45-55 and Fig 3).

Bernardi discloses lowering temperature to achieve a supersaturation condition. Bernardi does not disclose varying pressure to bring the solution to supersaturation.

In a solution growth method for synthesizing crystals, Dugger teaches the degree of supersaturation can be changed by changes in the pressure of the solution or controlled by a temperature of the solution (col 3, ln 1-25). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Bernardi with Dugger's pressure change to bring the solution to supersaturation because operating isothermally avoids undesirable temperature gradients in the melt forming crystals on the sidewalls of the reactor.

The combination of Bernardi and Dugger does not teach uniformly varying pressure by varying the pressure of a non-growth source constituent gas. It is conventionally known in the art to uniformly pressurize a vessel with an inert gas, this reads on applicant's non-growth source constituent gas, as evidenced by Omino (US 5,167,759) and Gault (US 4,521,272), below.

Referring to claim 1, the examiner interprets changes in the pressure of the solution to read on applicant's pressure of the system.

Referring to claim 9, the combination of Bernardi and Dugger teaches a temperature of 470°C and varying pressure to achieve supersaturation at 470°C.

5. Claims 3-4 and 6-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bernardi (US 4,906,325) in view of Dugger (US 5,503,103) as applied to claims 1-2 above, and further in view of Cook (US 4,519,871).

The combination of Bernardi and Dugger teaches all of the limitations of claim 3, as discussed previously in claims 1 and 2, except providing a second growth solution.

In a method of liquid phase epitaxy, Cook teaches a first solution is contacted with a substrate in a channel and an epitaxial layer of a first composition is grown to a desired thickness by liquid phase epitaxy and a second solution, separate from the first solution in then brought in contact with the substrate by moving a bubble across the substrate, thereby sweeping the first solution away and an epitaxial layer of a second composition is then grown on the substrate to a desired thickness by liquid phase epitaxy. Cook also discloses the process can be continued until the desired number of epitaxial layers have been grown of the substrate (col 1,ln 1-45). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Bernardi and Dugger with Cook's second growth solution because it produces superlattice semiconductor structures for use in electronic and optoelectronic devices (col 1, ln 1-5).

Referring to claim 4, the combination of Bernardi, Dugger and Cook teaches repeating the process of contacting the substrate with the first and second growth solution until a desired thickness is achieved.

Referring to claim 6, the combination of Bernardi, Dugger and Cook teaches a first growth solution, a second growth solution and a substrate at atmospheric pressure and heating the growth solutions above a saturation temperature and cooling to below the saturation temperature and varying pressure to control the degree of supersaturation, where a bubble moves the first solution out of contact of the substrate prior to contact with the second solution.

Referring to claim 7, the combination of Bernardi, Dugger and Cook teaches repeating the process of contacting the substrate with the first and second growth solution until a desired thickness is achieved.

6. Claims 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bernardi (US 4,906,325) in view of Dugger (US 5,503,103) as applied to claims 1-2 above, and further in view of Hsieh (US 4,142,924).

The combination of Bernardi and Dugger teaches all of the limitations of claim 10, as discussed previously in claims 1-2. The combination of Bernardi and Dugger teaches the deposition of mercury cadmium telluride layers, which is not a III-V epitaxial layer.

In a liquid epitaxy method for growing thin films, Hsieh teaches layers of III-V compounds can be formed from liquid phase epitaxy, where III-V semiconductors include GaSb (col 5, ln 5-20). Hsieh also teaches a GaAs wafer **6,** a supersaturated

solution of GaAs **8** and the substrate is contacted with the solution to grow a thin film of GaAs on the GaAs wafer at 800°C (col, 3, ln 1-35 and col 2, ln 50-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Bernardi and Dugger with Hsieh's growth solution of III-V semiconductor compounds because III-V semiconductors are useful in the opto-electronics industry.

Referring to claim 11, the combination of Bernardi, Dugger and Hseih teaches GaSb.

7. Claims 1 and 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsieh (US 4,142,924) in view of Dugger (US 3,933,573).

Hsieh discloses a liquid phase epitaxy growth of GaAs on a GaAs substrate **6** from a solution of GaAs **8**, where the growth is carried out under flowing H_2 (col 2, ln 50-67). Hsieh also discloses the solution and the substrate are heated in an oven substantially above their equilibrium temperature, this reads on applicant's saturation temperature, and the solution and substrate are then cooled in the oven to a temperature below the solution equilibrium temperature, where substrate contacts the solution to form a thin layer of GaAs on the GaAs substrate at a temperature of 800°C (col 3, ln 5-60). Hsieh also teaches layers of III-V compounds can be formed from liquid phase epitaxy, where III-V semiconductors include GaSb (col 5, ln 5-20).

Hsieh is silent to varying the pressure of the system to change the degree of supersaturation of the growth solution.

In a solution growth method for synthesizing crystals, Dugger teaches the degree of supersaturation can be changed by changes in the pressure of the solution or controlled by a temperature of the solution (col 3, ln 1-25). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Hsieh with Dugger's pressure change the degree of supersaturation because control of the supersaturation prevents homogeneous nucleation in the solution, which prohibits growth on a substrate.

The combination of Hsieh and Dugger does not teach uniformly varying pressure by varying the pressure of a non-growth source constituent gas. It is conventionally known in the art to uniformly pressurize a vessel with an inert gas, this reads on applicant's non-growth source constituent gas, as evidenced by Omino (US 5,167,759) and Gault (US 4,521,272), below.

Referring to claim 1, the examiner interprets the changing of the pressure of the solution to read on applicant's pressure of the system.

Referring to claim 8, the combination of Hsieh and Dugger teaches a temperature of 800°C.

Referring to claim 9, the combination of Hsieh and Dugger teaches a temperature of 800°C.

Referring to claim 10, the combination of Hsieh and Dugger teaches GaSb, a group III-V semiconductor.

Referring to claim 11, the combination of Hsieh and Dugger teaches GaSb.

8. Claims 2 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsieh (US 4,142,924) in view of Dugger (US 3,933,573) as applied to claim1 above, and further in view of Bernardi (US 4,906,325).

The combination of Hsieh and Dugger teaches all of the limitation of claim 2, as discussed previously in claim 1, except the growth solution and substrate are provided at atmospheric pressure. The combination of Hsieh and Dugger teaches a flow of H_2 is flowed during the growth process but is silent to the pressure.

In a method of forming thin films from solution, Bernardi teaches a hydrogen flow is maintained under atmospheric pressure in order to avoid an oxidative phenomena (col 3, ln 35-40). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Hsieh and Dugger with Bernardi's hydrogen pressure of atmospheric pressure because it avoids oxidation.

Referring to claim 5, the combination of Hsieh, Dugger and Bernardi teaches a first growth solution and substrate under a flow of H_2 at atmospheric pressure and heating to above a saturation temperature and cooling to below the saturation temperature and maintaining at 800°C while varying pressure to control the degree of supersaturation and contacting the substrate with the solution thereby forming a thin film, i.e. solid layer.

9. Claims 3-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsieh (US 4,142,924) in view of Dugger (US 3,933,573) along with Bernardi (US 4,906,325) as applied to claim 2 above, and further in view of Cook (US 4,519,871).

In a method of liquid phase epitaxy, Cook teaches a first solution is contacted with a substrate in a channel and an epitaxial layer of a first composition is grown to a

desired thickness by liquid phase epitaxy and a second solution, separate from the first solution in then brought in contact with the substrate by moving a bubble across the substrate, thereby sweeping the first solution away and an epitaxial layer of a second composition is then grown on the substrate to a desired thickness by liquid phase epitaxy. Cook also discloses the process can be continued until the desired number of epitaxial layers have been grown of the substrate (col 1,ln 1-45). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Hsieh, Dugger and Bernardi with Cook's second growth solution because it produces superlattice semiconductor structures for use in electronic and optoelectronic devices (col 1, ln 1-5).

Referring to claim 4, the combination of Hsieh, Dugger, Bernardi and Cook teaches varying pressure of a second growth solution controls the degree of supersaturation.

Referring to claim 5, the combination of Hsieh, Dugger, Bernardi and Cook teaches heating above an equilibrium temperature, this reads on applicant's saturation temperature under atmospheric pressure and setting the temperature below the saturation temperature and varying the pressure to control the degree of supersaturation and contacting a substrate with a growth solution, thereby depositing a thin film, i.e. solid layer.

Referring to claim 6, the combination of Hsieh, Dugger, Bernardi and Cook teaches heating above an equilibrium temperature, this reads on applicant's saturation temperature under atmospheric pressure and setting the temperature below the saturation temperature and varying the pressure to control the degree of supersaturation and

contacting a substrate with a growth solution, thereby depositing a thin film, i.e. solid layer. The combination of Hsieh, Dugger, Bernardi and Cook also teaches a first growth solution is moved from the substrate by a bubble, this reads on applicant's moving the substrate out of contact with the first growth solution.

Referring to claim 7, the combination of Hsieh, Dugger, Bernardi and Cook teaches repeating steps until a desired thickness is achieved.

Referring to claim 8, the combination of Hsieh, Dugger, Bernardi and Cook teaches a temperature of 800°C.

Referring to claim 9, the combination of Hsieh, Dugger, Bernardi and Cook teaches a constant temperature.

Referring to claim 10, the combination of Hsieh, Dugger, Bernardi and Cook teaches GaAs a group III-V semiconductor.

Referring to claim 11, the combination of Hsieh, Dugger, Bernardi and Cook teaches GaSb.

Response to Arguments

10. Applicant's arguments filed 12/27/2002 have been fully considered but they are not persuasive.

The Bauser rejection is withdrawn.

Applicant's argument that the teaching of Dugger is an insufficient disclosure as compared to applicant's multipage disclosure has been noted but is not found persuasive. Dugger teaches the degree of supersaturation can be changed by changes in pressure of a solution, note column 3, lines 15-20. This teaching is much less compared to applicants

disclosure, however the teaching is not being compared to applicants disclosure. The teaching of Dugger are sufficient for a person of ordinary skill at the time of the invention to change the degree of supersaturation of a solution by applying a pressure to the solution or by changing the temperature of the solution. Furthermore, applicant's allegation that Dugger's teaching is insufficient is mere attorney argument.

Applicant's argument that there is no futher prior art on pressure controlled supersaturation in liquid phase epitaxy is noted but is not found persuasive. The teaching of Dugger is sufficient and additional prior art documents are not required for establishing a prima facia case of obviousness. Also, applicant's allegation that Dugger's teaching is insufficient is mere attorney argument. Furthermore, Liao (EP 0 922 488 A2) is cited as an additional teaching of controlling a supersaturated solution by applying a pressure to the solution [0026].

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., a two dimension thin film (pg 10 first paragraph)) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Claim 1 recite a "method of growing semiconductor epitaxial layers" in lines 1-2. Claim 1 does not recite the layer are two-dimensional or are thin films.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871

(CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). The Dugger reference is not provided as a teaching of epitaxial growth, but is provided solely as a teaching of an alternative method of controlling the degree of supersaturation of a solution using pressure. The Bernardi reference and the Hseih reference teach epitaxial growth from a solution.

In response to applicant's argument that Dugger is nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, the Dugger reference is a related because it teaches single crystal growth from a supersaturated solution. The Dugger reference grows different crystal in a particular embodiment, however, is not as limited as suggested by applicant because Dugger's teaching is for crystal growth form supersaturated solutions in general.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Cook is provided solely as a teaching of a second growth solution. Dugger teaches the pressure change to the growth solution.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Omino (US 5,167,759) teaches a crucible is placed in a high pressure vessel and the vessel is pressurized with an inert gas and a crystal is allowed to grow (col 1, ln 40-50).

Gault (US 4,521,272) teaches a container is positioned in an apparatus and is pressurized to a desired pressure with an inert gas (col 5, ln 50-65).

Liao (EP 0 922 488 A2) teaches a solution of a supersatured state can be obtained using a conventional method, for example, cooling a solution or applying a pressure to a solution [0026].

Porowski et al (US 5,637,531) teaches a method of making a crystalline structure at two pressures, where the a lower pressure results in a slower growth rate (Abstract).

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 703-305-4953. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin L Utech can be reached on 703-308-3868. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

BENJAMIN L. UTECH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700

Matthew J Song
Examiner
Art Unit 1765

MJS
July 11, 2003